

FINAL DESIGN



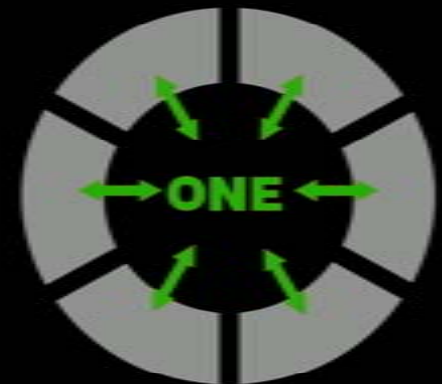
GROUP 1:

CRAIG CASEY, PETER CLARKE, TRAVIS FLOHR, JUSTIN MILLER
AZADEH RABBANI, JONATHAN TORCH

1

INTRODUCTION

GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 497A

BIM STUDIO
GROUP 1

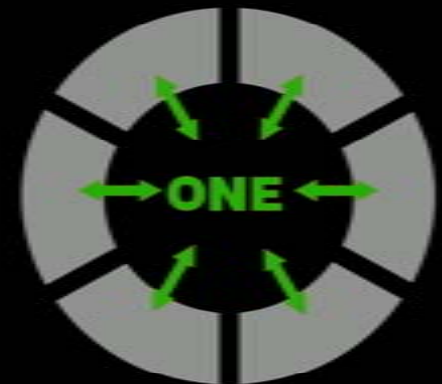


DESIGN GOALS

- Sustainability
 - Minimal Site Disturbance
 - Make the most out of site resources
 - Soil, Wind, Water, Solar and Topography
 - Create a healthier environment
 - Inspire students to be more sustainable
 - Reduce, Reuse and Recycle
- Create and foster a healthy learning environment
 - Occupant health, fitness and productivity
- Resilient Design
 - As technology develops, building can adapt
 - Ability to expand if district grows

2

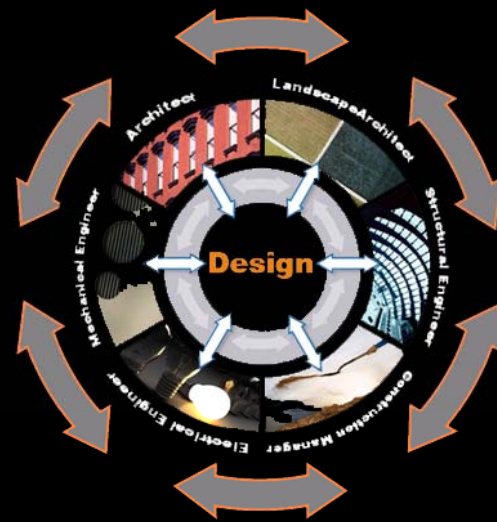
INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 497A

BIM STUDIO
GROUP 1

BIM

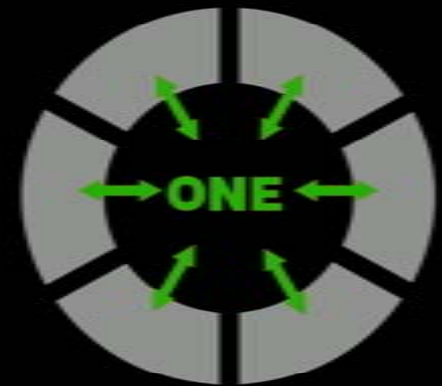


BIM GOALS

- Coordination:
 - Central file
 - Clash detection with Navisworks
- Organization:
 - Quantity takeoffs from Revit
- Deliverables:
 - 4D Model/Schedule
 - Renderings
- Information

3

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 447A

BIM STUDIO
GROUP 1

DESIGN OVERVIEW

Elementary School
Total Square Footage – 108,000
Number of Classrooms – 40

Architecture:

- Classrooms Facing south
- Natural light in every space
- Live interactive space
- Building as an educational tool

Structure:

- 3-story steel framed (composite) classroom structure
- 1-2 story ICF bearing walls/Joist spanning
- Lateral Resisting System
 - Moment Framed (North-South Direction)
 - Shear Walls (East-West Direction)
- Foundations:
 - Continuous & Spread Footings
 - 6 Inch Slab on Grade

Landscaping:

- Prototype Site Cost: \$5,179,788.00
- Current Site Design: \$4,119,667.00
 - - \$400,000 worth of curb
 - - \$500,000 worth of storm sewer

Lighting:

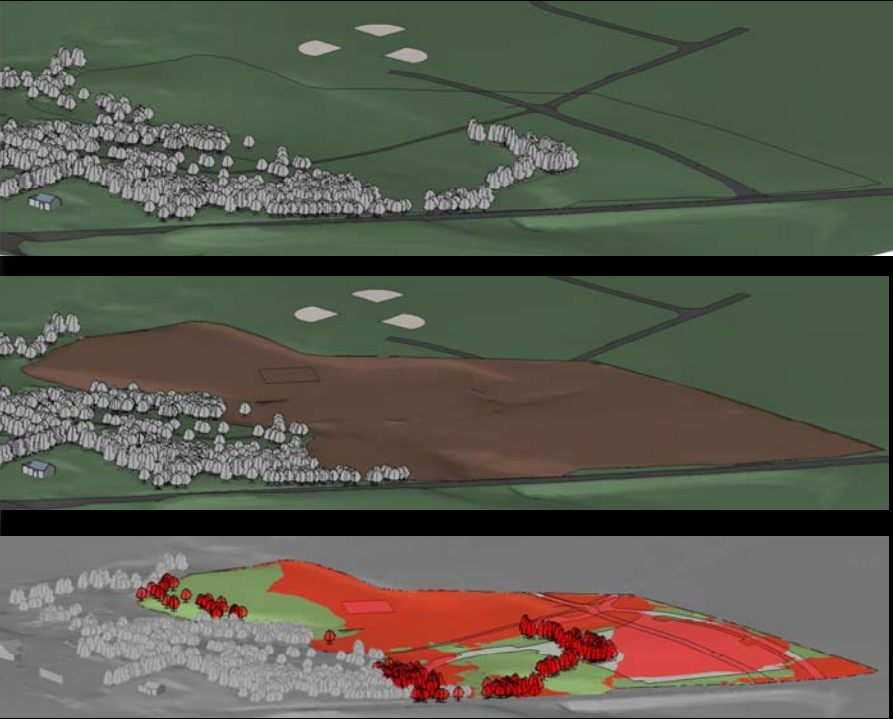
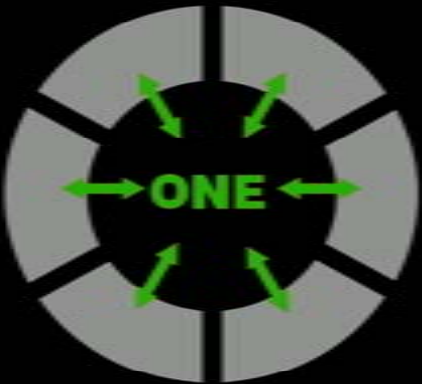
- Distribution Systems:
 - 480Y/277 – Main Lighting/Large Equipment
 - 208Y/120 – Receptacle Loads
- Balance of day-lighting with artificial light

Mechanical:

- Decentralized mechanical room layout
- Ground Source Heat Pumps
- 3 acre geothermal field

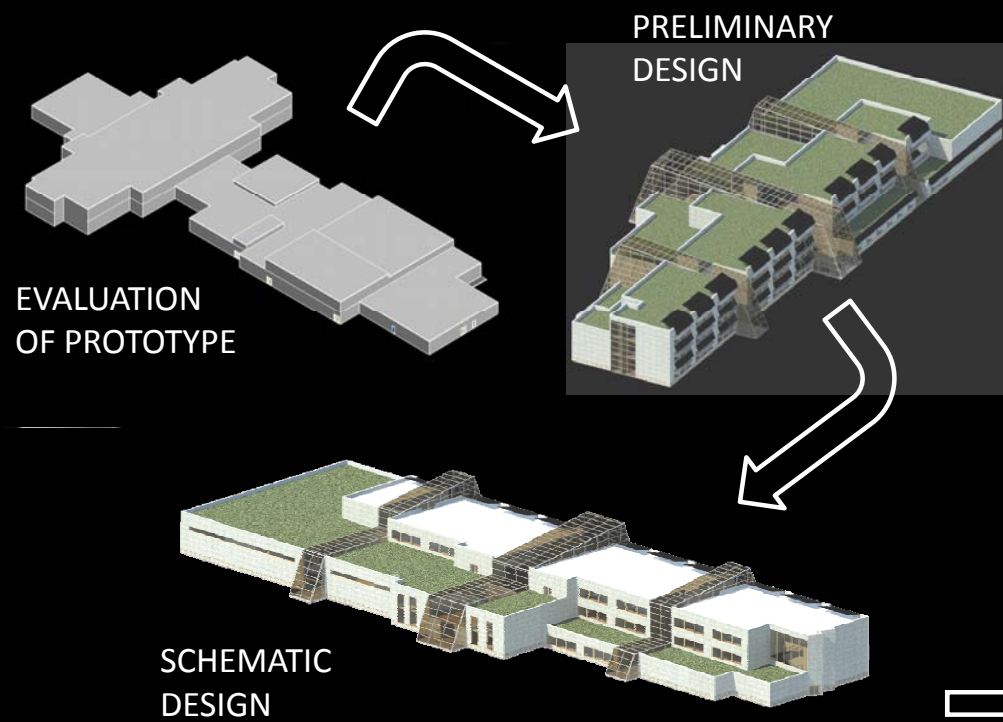
4

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 497A

BIM STUDIO
GROUP 1



DESIGN OVERVIEW

Design Emphasis – Sustainability

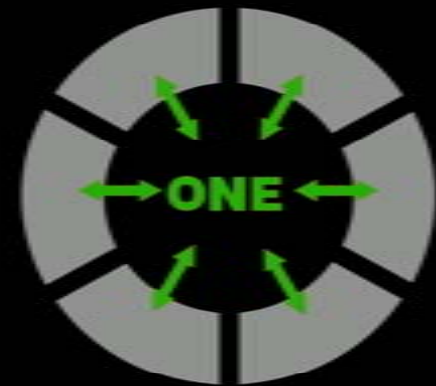
- Maximize Day-lighting Exposure
- Solar Energy
- Minimize Footprint



FINAL DESIGN & BIM ANALYSIS

5

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



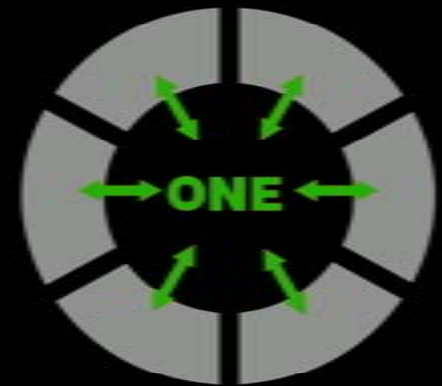
ARCH 497A

BIM STUDIO
GROUP 1



6

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU

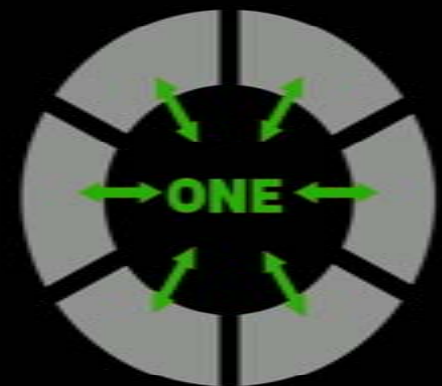




1st Floor

7

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 497A

BIM STUDIO
GROUP 1



2nd Floor

8

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 497A

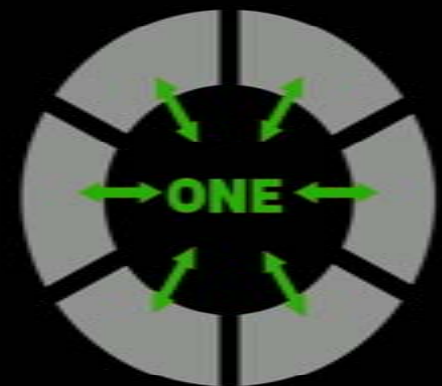
BIM STUDIO
GROUP 1



3rd Floor

9

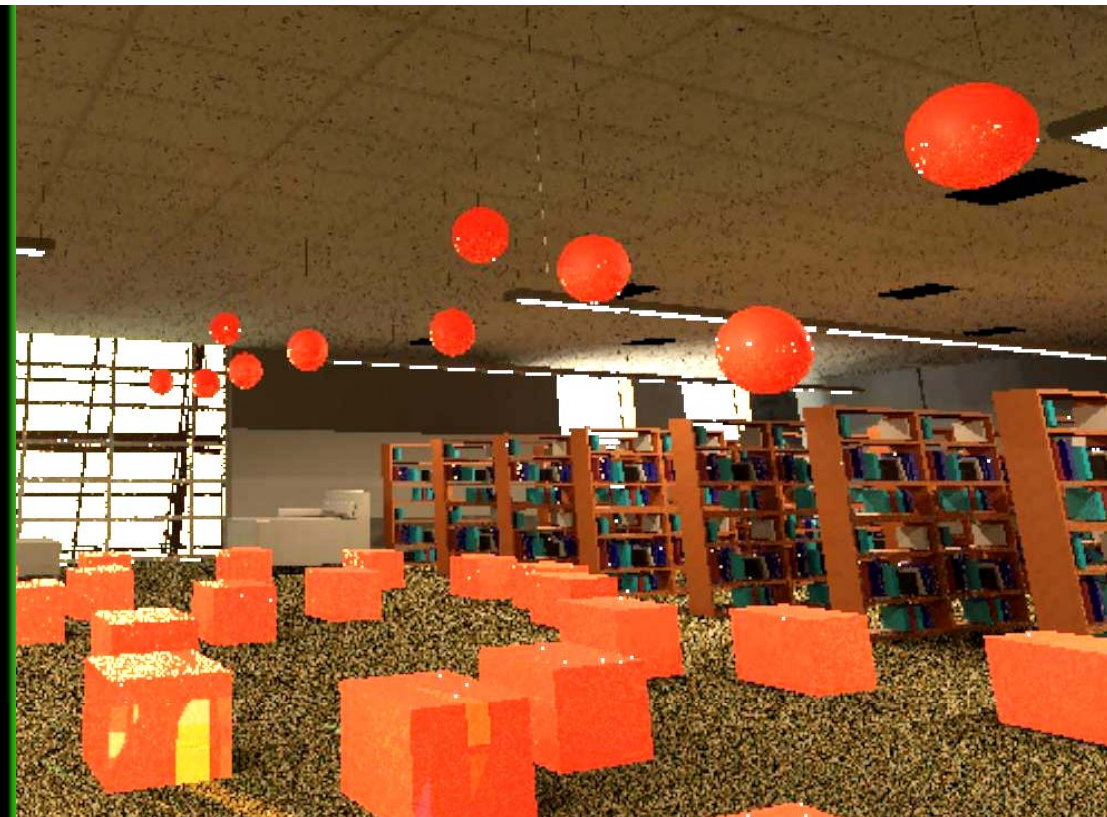
INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 497A

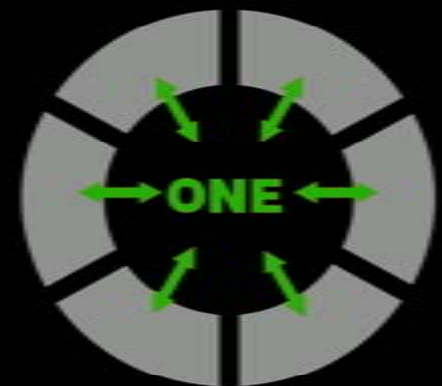
BIM STUDIO
GROUP 1

Media Room Interior



10

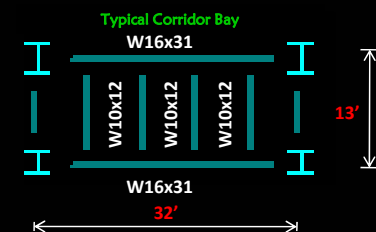
INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



LIGHT WELL DESIGN

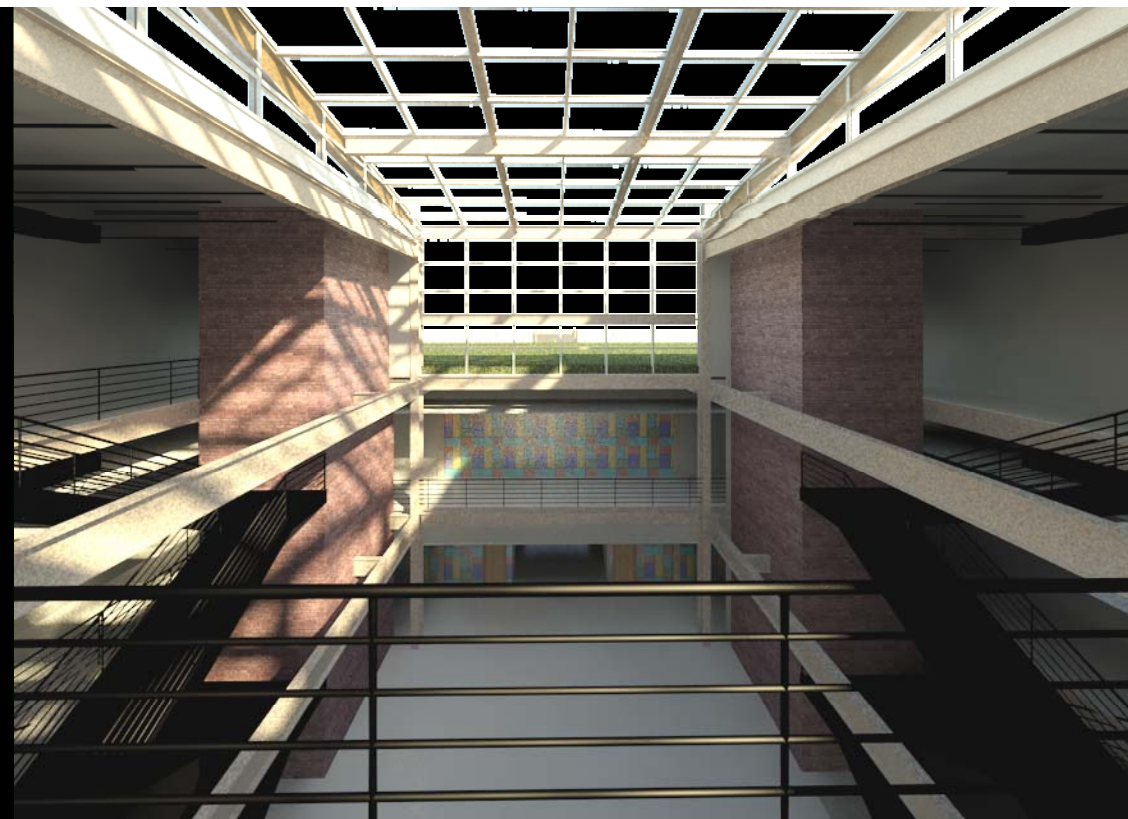
Structure:

- Atrium exposed structure
- Exposed members painted for fire protection
- Corridor designed for large plenum space available for mechanical



Construction:

- Reduction of size from original proposed design
- Completed after substantial MEP completion

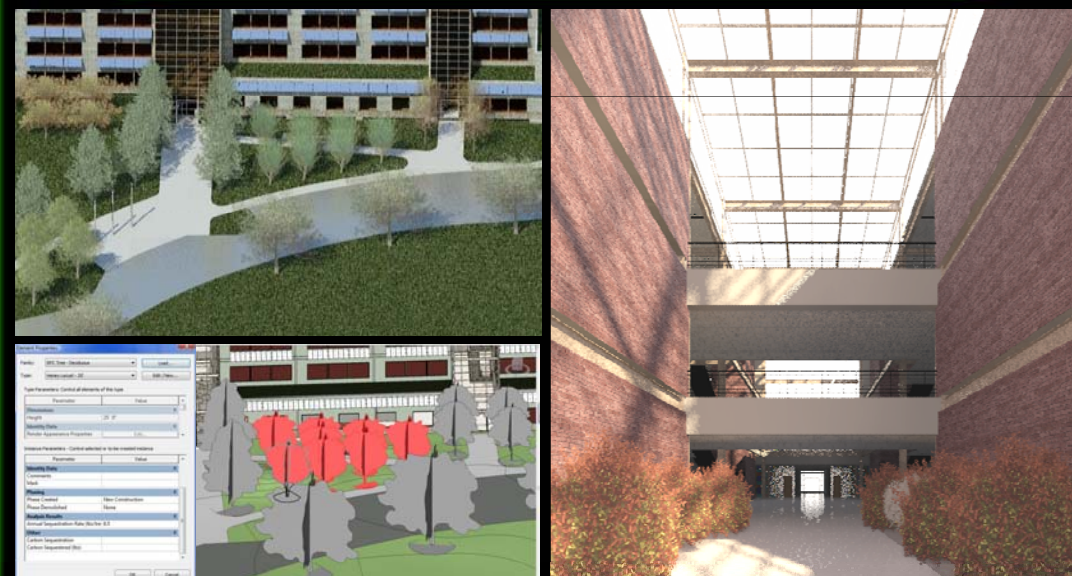


11

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU

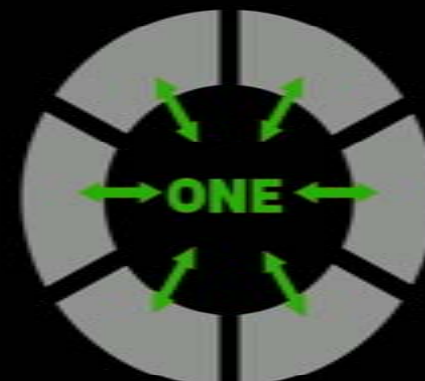


LIGHT WELL DESIGN



12

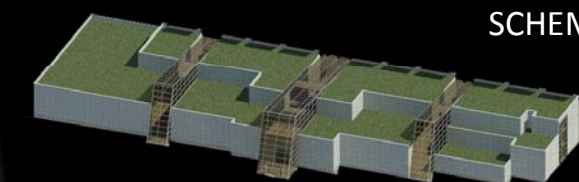
INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 447A

BIM STUDIO
GROUP 1

SCHEMATIC DESIGN



Reduce glazing
and provide
translucent glazing



FINAL DESIGN

Lighting:

- Glazing Materiality
- Low clearance fixtures
- Main conduit run

Mechanical:

- Solar heat gain
- Duct runs
- Displacement ventilation

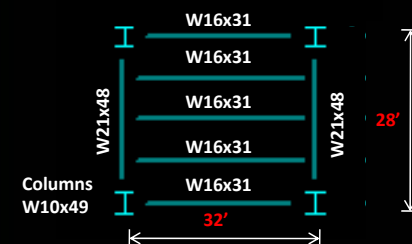
Landscaping:

- Solar shading
- Indoor/Exterior CO₂ levels
- Solar panels



TYPICAL CLASSROOM DESIGN

STRUCTURE – Typical Classroom Bay



LIGHTING

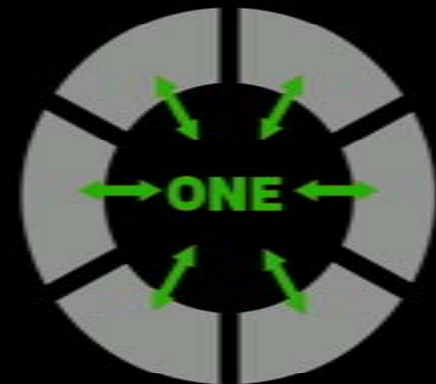
- Indirect Linear Florescent
- Daylight control sensors

MECHANICAL

- Ceiling supply with return plenum
- Each classroom has its own zone

13

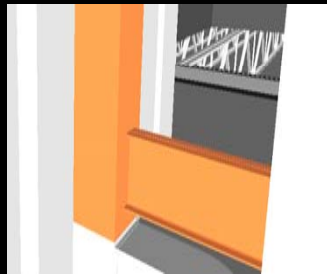
INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



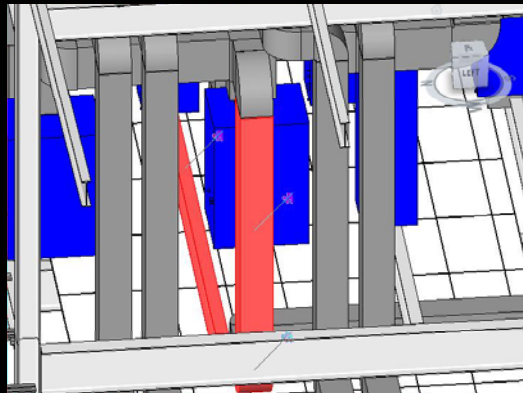
ARCH 497A

BIM STUDIO
GROUP 1

CLASH FOUND IN NAVISWORKS



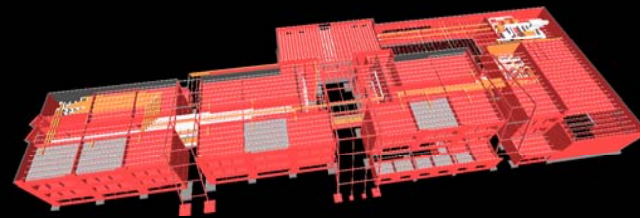
CLASH FIXED IN REVIT



CLASH DETECTION

OVERVIEW

- Found in Navisworks: >5000 clashes
- Problems with exporting from Revit

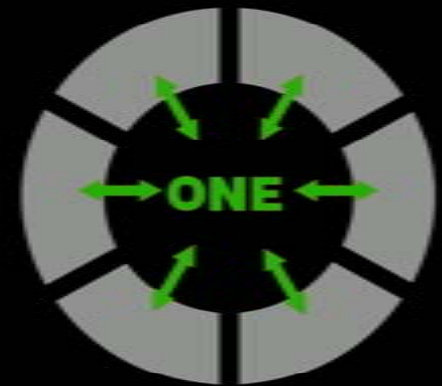


OPERATOR ERROR

- Duct/beam clash between the 2nd and 3rd floor East mechanical rooms
- Clash was detected in Navisworks and fixed in Revit

14

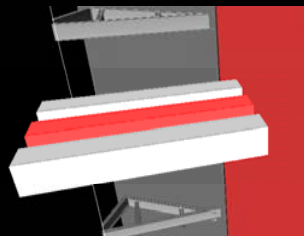
INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



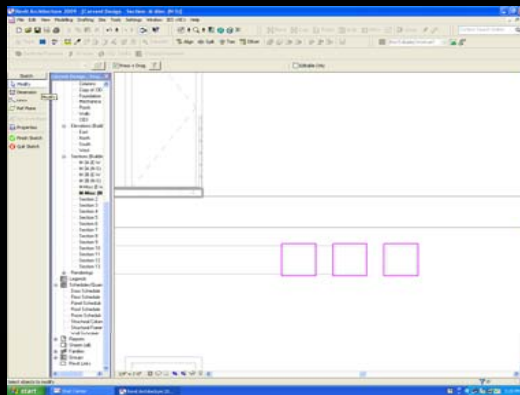
ARCH 447A

BIM STUDIO
GROUP 1

CLASH FOUND IN NAVISWORKS



CLASH FIXED IN REVIT



CLASH DETECTION

STRUCTURAL ~ PROGRAMMING FLAWS

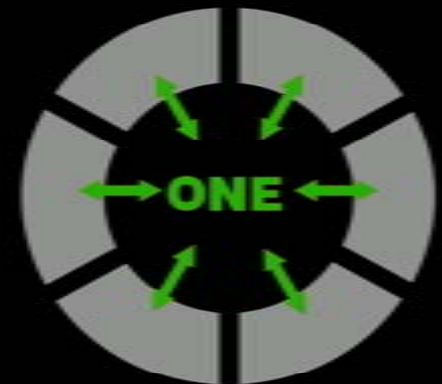
- Automatic beam connection problems in atrium
 - Non-perpendicular connections did not work

MECHANICAL ~ PROGRAMMING FLAWS

- Duct/pipe clashes with walls
- Analogy: Placing a door/window removes an opening in the wall.
 - Why can't this apply for ducts/pipes?

15

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 447A

BIM STUDIO
GROUP 1

4D MODEL

Revit Architecture 2009

Revit MEP 2009

Revit Structure 2009

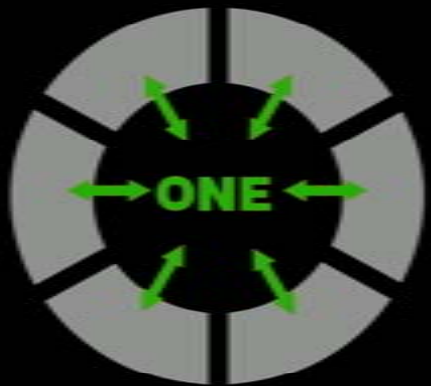
R.S. Means Cost and Productivity Data

Microsoft Project

Navisworks Manage 2009

16

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 447A

BIM STUDIO
GROUP 1

Long Lead Time Items

- Structural columns and framing
- Curtain wall systems
- Photovoltaic panels
- Insulated Concrete Forms
- Geothermal system
 - Custom AHU
- 3-Form wall systems for media room, computer classrooms, typical classrooms, and office area



CONSTRUCTABILITY & VALUE ENGINEERING

Photovoltaic Panels

- Energy savings

Light Wells

- Supply sunlight within building
- Size was reduced to save material and cooling cost

Recycled Materials

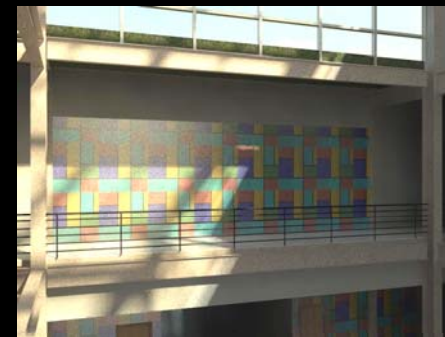
- 3-Form recycled materials
 - Adds color to playful atmosphere
 - Partially transparent to allow light through

Insulated Concrete Forms

- Structural and non-structural use
- No wasted formwork

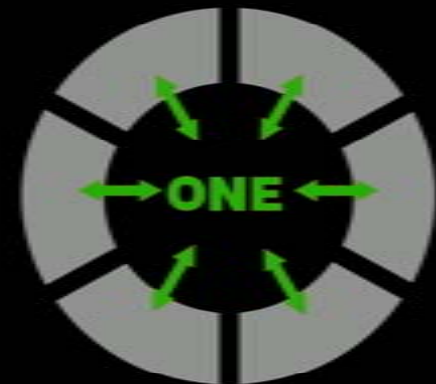
Geothermal

- Used throughout building



17

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 447A

BIM STUDIO
GROUP 1

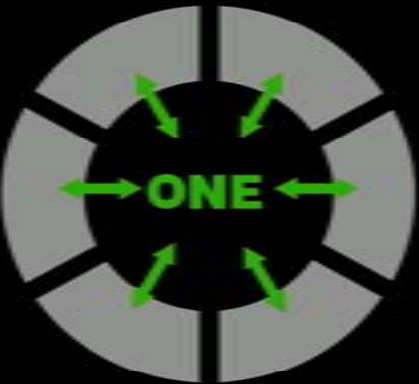
Structural Column Schedule									
Mark	Family and Type	Base Level	Assembly Description	Count	Length	Volume	Tons	Daily Outputs	
A	W-Wide Flange-Column: W10X49	Level 1	Superstructure	10	1400.51 CY				
A	W-Wide Flange-Column: W10X49	Level 2	Superstructure	8	1120.41 CY				
A	W-Wide Flange-Column: W10X49	Level 3	Superstructure	8	133.50 49 CY				
W-Wide Flange-Column: W10X49: 26				26	385.51 41 CY		9.44475	0.373546512	
				26	385.51 41 CY		9.44475	0.373546512	
B	W-Wide Flange-Column: W10X49	Level 1	Superstructure	18	2520.92 CY				
B	W-Wide Flange-Column: W10X49	Level 2	Superstructure	14	2350.86 CY				
B	W-Wide Flange-Column: W10X49	Level 3	Superstructure	13	1920.7 CY				
W-Wide Flange-Column: W10X49: 45				45	6792.48 CY		16.6355	0.657945736	
B	W-Wide Flange-Column: W16X77	Level 1	Superstructure	4	850.49 CY				
B	W-Wide Flange-Column: W16X77	Level 2	Superstructure	3	650.38 CY				
B	W-Wide Flange-Column: W16X77	Level 3	Superstructure	2	490.28 CY				
W-Wide Flange-Column: W16X77: 9				9	1991.15 CY		7.6615	0.202235772	
				54	8783.63 CY		24.297	0.860181509	
C	W-Wide Flange-Column: W10X49	Level 1	Superstructure	14	1960.72 CY				
C	W-Wide Flange-Column: W10X49	Level 2	Superstructure	14	2190.8 CY				
C	W-Wide Flange-Column: W10X49	Level 3	Superstructure	10	151 420.55 CY				
W-Wide Flange-Column: W10X49: 38				38	566 422.07 CY		13.87729	0.548856589	
C	W-Wide Flange-Column: W16X77	Level 1	Superstructure	4	850.49 CY				
C	W-Wide Flange-Column: W16X77	Level 2	Superstructure	3	650.38 CY				
C	W-Wide Flange-Column: W16X77	Level 3	Superstructure	2	490.28 CY				
W-Wide Flange-Column: W16X77: 9				9	1991.15 CY		7.6615	0.202235772	
				47	765 423.22 CY		21.53879	0.751092362	
D	W-Wide Flange-Column: W10X49	Level 1	Superstructure	15	2100.77 CY				
D	W-Wide Flange-Column: W10X49	Level 2	Superstructure	15	2330.85 CY				
D	W-Wide Flange-Column: W10X49	Level 3	Superstructure	11	1660.61 CY				
W-Wide Flange-Column: W10X49: 41				41	6092.22 CY		14.9205	0.590116279	
				41	6092.22 CY		14.9205	0.590116279	

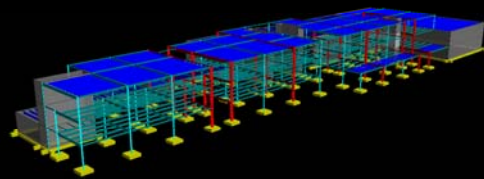
DETAILED STRUCTURAL ESTIMATE

				Structural concrete, ready mix, lightweight, 110 w/c.F., 2500 psi, includes lightweight aggregate, sand, portland cement and water, excludes all additives and treatments														
278	033116100740							C.Y.		\$	138.00	\$	-	\$	-	\$	138.00	
2240	051223177150			Column, structural, 2-tier, W12x50, A992 steel, incl shop primer, splice plates, bolts	E2	1032	0.054	L.F.		\$	82.50	\$	2.36	\$	1.69	\$	86.55	
398	051223177350			Column, structural, 2-tier, W14x74, A992 steel, incl shop primer, splice plates, bolts	E2	984	0.057	L.F.		\$	122.00	\$	2.48	\$	1.77	\$	126.25	
1788.5	051223750600			Structural steel member, 100-ton project, 1 to 2 story building, W10x12, A992 steel, shop fabricated, incl shop primer, bolted connections	E2	600	0.093	L.F.		\$	19.80	\$	4.06	\$	2.90	\$	26.76	
1924.5	051223751300			Structural steel member, 100-ton project, 1 to 2 story building, W12x22, A992 steel, shop fabricated, incl shop primer, bolted connections	E2	880	0.064	L.F.		\$	36.50	\$	2.77	\$	1.98	\$	41.25	
7482.5	051223752900			Structural steel member, 100-ton project, 1 to 2 story building, W16x31, A992 steel, shop fabricated, incl shop primer, bolted connections	E2	900	0.062	L.F.		\$	51.00	\$	2.71	\$	1.93	\$	55.64	
849.33	051223753500			Structural steel member, 100-ton project, 1 to 2 story building, W18x40, A992 steel, shop fabricated, incl shop primer, bolted connections	E5	960	0.083	L.F.		\$	66.00	\$	3.67	\$	1.95	\$	71.62	
2446.34	051223754300			Structural steel member, 100-ton project, 1 to 2 story building, W21x50, A992 steel, shop fabricated, incl shop primer, bolted connections	E5	1064	0.075	L.F.		\$	82.50	\$	3.32	\$	1.76	\$	87.58	














18

\$ 3,425,270.65



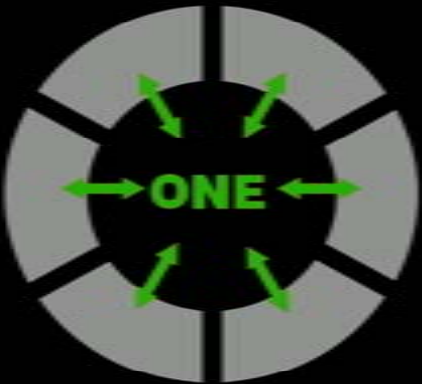


BIM EXPERIENCE

SOFTWARE WORKFLOW		
RAM	 	REVIT
IES		REVIT
AGI	 	REVIT
GIS	 	REVIT
AUTOCAD CIVIL 3D	 	REVIT
NAVISWORKS		REVIT
AUTOCAD	 	REVIT
3DSTUDIO MAX		REVIT

19

- INTRODUCTION
- GOALS
- DESIGN
- ARCHITECTURE
- LIGHT WELL
- TYPICAL CLASSROOM
- CLASH DETECTION
- CONSTRUCTION
- BIM
- REVIT
- THANK YOU



ARCH 447A

BIM STUDIO
GROUP 1

REVIT EXPERIENCE

LARCH - Bad

- No site grading
- Minimal site components
- Sub regions

STRUCTURAL - Bad

- Angular connections
- 3D workspace

CM - Bad

- Quantity take-off
- Phasing

LARCH - Good

- Easily validate design
- C.D. automation

STRUCTURAL - Good

- Member design change
- C.D. automation

CM - Good

- Easy schedules
- Easy manage design changes

ELECTRICAL - Bad

- No clash detection
- No conduits
- Electrical system selection

MECHANICAL - Bad

- Auto connect feature
- Wall penetrations
- Detail level

ARCHITECTURE - Bad

- Modifications
- Not design friendly
- Conceptual flexibility

ELECTRICAL - Good

- Wiring diagrams
- Wire sizing
- Panel schedule

MECHANICAL - Good

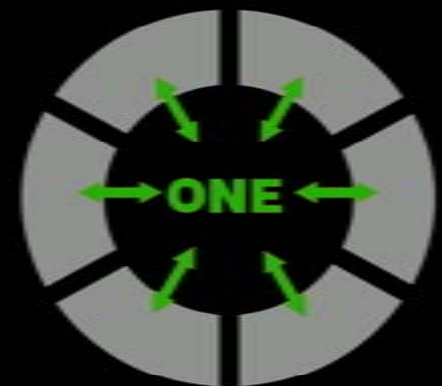
- Easy to place pipes and ducts
- Infrastructure with IES

ARCHITECTURE - Good

- C.D. automation
- Extensive library
- 2D-3D

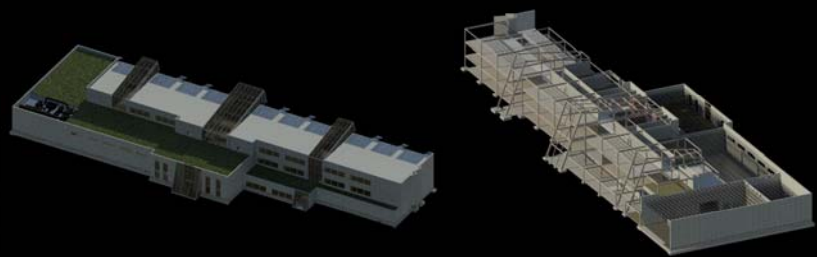
20

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



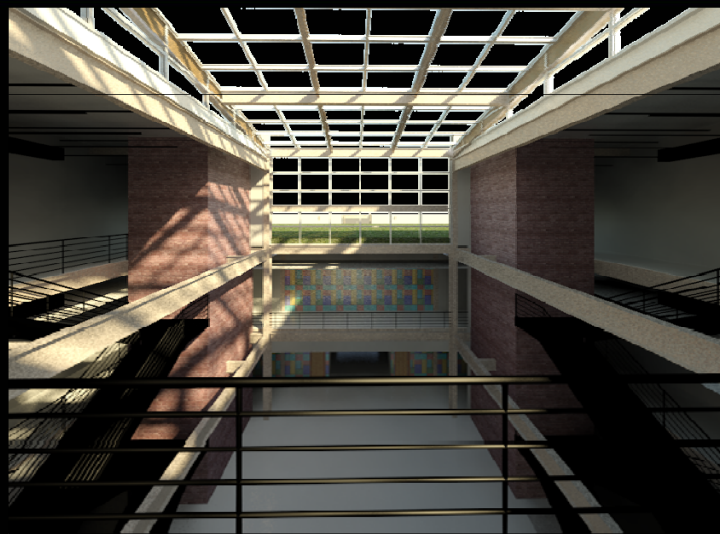
ARCH 447A

BIM STUDIO
GROUP 1



COMMENTS/QUESTIONS?

THANK YOU



GROUP 1:
CRAIG CASEY, PETER CLARKE, TRAVIS FLOHR, JUSTIN MILLER
AZADEH RABBANI, JONATHAN TORCH

21

INTRODUCTION
GOALS
DESIGN
ARCHITECTURE
LIGHT WELL
TYPICAL CLASSROOM
CLASH DETECTION
CONSTRUCTION
BIM
REVIT
THANK YOU



ARCH 447A

BIM STUDIO
GROUP 1